

## Remarks

Claims 1-21 are currently pending. Support for the amendment to Claim 1 can be found, for example, in page 12, lines 7-10 with regard to the definition of the hair cells.

The amendments in the last paragraph of Claim 1, which indicate that the pitch line varies in the time over frequency, i.e. from hair cell to hair cell, are supported by Fig. 7, clearly indicating that the pitch line goes from lower frequencies at the 100 range up to higher frequencies at the 200 range and back. Naturally, the pitch analysis is determined by the pitch analyzer.

Applicants add new Claims 23 and 24. Support for Claims 23 and 24 can be found, for example, on page 7, 23, 28, 31, and 34 of the specification. Specifically, page 7, line 11 and page 13, line 3 disclose the transcription. Page 7, line 17 and page 23, line 20 disclose the sound source recognition and the music recognition. Page 34, second paragraph and page 35, first paragraph disclose the query by humming process; page 28, line 19 and Fig. 7 disclose the display of the pitch line over time; page 31, line 2 discloses the extraction of auditory streams and the identification of performing singers. Finally, page 32, line 16 discloses the instrument recognition.

### 35 USC 101

The Examiner rejects Claims 1-21 under 35 USC 101 because the claimed invention is directed to non-statutory subject matter. Applicants amend Claims 1-20 to recite that the apparatus is a hardware apparatus. Support for this amendment can be found, for example, on page 36 of the specification.

The Examiner asserts that the apparatus claims are not statutory because there is no physical transformation. The Federal Circuit recently stated that method claims must either be tied to an apparatus or recite a transformation. See *In re Bilski*, 545 F.3d 943, 961 (Fed. Cir. 2008). This test is not used, however, for apparatus claims because the apparatus is already tied to the abstract idea. Here, the hardware apparatus is analyzing the sound signal.

The Examiner also asserts that the claims fails to recite statutory subject matter because "the claim does not produce a useful, concrete, and tangible result." This test came from

*State Street*. Applicants respectfully point out that the Federal Circuit stated in *In re Bilski* that the portions of *State Street* that result upon the useful, concrete and tangible result should no longer be relied upon for determining patent eligibility. 545 F.3d at 960.

Because Claims 1-20 recite a physical apparatus that analyzes sound, the claims are patentable.

Applicants amend Claim 21 to recite that the method of analyzing is implemented in hardware in the form of a state machine or in software, which is executed by a programmable processor for performing the method of analyzing. Support for this amendment can be found, for example, on page 36 of the specification. Because Claim 1 is tied to a machine, Claim 21 is patentable.

Applicants add new Claims 23 and 24.

### **35 USC 102(b)**

The Examiner rejects Claims 1 and 21 under 35 USC 102(b) as being anticipated by Holton (US Patent 5,381,512). Applicants respectfully traverse.

Regarding the second paragraph of Claim 1, the ear model, has the important feature that there is an inner hair cell cleft content map over frequency and over time. The Examiner points to col. 24, lines 54-68 in Holton, but all channels in Fig. 19, col. 24 are only fully separated frequency channels  $x_i$ , where there does not exist any cross-over between the frequencies. Therefore, one cannot say that this is a map over frequency and time, such as the map illustrated in Fig. 3, which is a map in frequency (the first axis) and in time, *i.e.* the second axis and with a certain amplitude value, *i.e.* the cleft content in the third dimension.

Furthermore, the Examiner points to col. 25, lines 1-67, but again, this complete passage discloses several issues, but does not disclose an inner hair cell cleft contents map over frequency and over time, where we have a – let's say – three-dimensional representation indicated, for example, in Fig. 3 of the application. Instead, all individual time lines in Fig. 19 for each individual channel are on the time lines indicating a certain value over time, but nowhere is there any disclosure of an inner hair cell cleft content value on the one hand and that there is not only a one-dimensional time line, but a two-

dimensional map, where the two dimensions are frequency on the one hand and time on the other hand, and where the third dimension is the content per frequency point and time point. However, the feature is important, since the feature analyzer performs a two-dimensional analysis due to the fact that the pitch is varying over time and over frequency as is now included in amended Claim 1. This is the very nature of a pitch, *i.e.* that the pitch is not constant in frequency, but varies in frequency over time. Since Holton only discloses a time analysis of the individual channel signals, a pitch analysis cannot be performed and, in fact, is not performed as I will discuss subsequently.

Regarding col. 26, lines 1-32, Applicants cannot see a cleft content and a cleft content map over frequency and over time; neither can Applicants see any description thereof. Applicants respectfully request that the Examiner indicate where there is an inner hair cell cleft content disclosed in Holton, and, specifically, where a map over frequency and time for this inner hair cell cleft content is disclosed in Holton. "When a reference is complex or shows or describes inventions other than that claimed by the applicant, the particular part relied on must be designated as nearly as practicable." 37 CFR 1.104(2).

Regarding the pitch analyzer feature, the Examiner points to Fig. 2A – 2B and associated text. However, col. 8, lines 9-13 disclose the main feature of Holton, which is not a pitch analysis: "One of the principle features of this invention is that linguistically important speech features such as the location of the glottal pulses and formant frequencies can be determined".

It is clear that "the location of the glottal pulses" is different from a pitch, and it is also clear that formant frequencies are not pitch frequencies. Instead, Holton itself explains what is understood as a formant, *i.e.* "resonances of the vocal tract" as outlined in col. 21, line 10. When the speech model is considered it becomes clear that the pitch is the fundamental frequency illustrating the movement of the vocal chords, which excite the vocal tract. Hence, the formants are, therefore, completely different from the pitch.

Additionally, if the vocal tract of a human being is bound by the physiological "design" of the mouth/pharynx, it is clear that the formants will not be timely varying. Instead, the formants, *i.e.* the shape of the mouth/nose/pharynx of a person is as it is. In view of that, it is not surprising that Holton performs a frequency-channel bound processing without

using a map over frequency and time in order to find out the formant of a person, which is very characteristic for a person, but which is at a predetermined frequency.

The situation is completely different for the pitch. When a woman is speaking, the pitch, *i.e.* the fundamental frequency of the speech signal will be higher compared to the situation, in which a man is speaking. Analogously, the pitch of a child is higher than the pitch of an adult and, importantly, when a human being is speaking, the speaker will never have the same pitch frequency over time, since it is a decisive feature of the human speech that the pitch is always varying. Sometimes one speaks with a high voice or with a low voice.

Therefore, a formant analysis does not require the determination of a formant varying with frequency, but this is an important feature for the pitch analysis.

On the other hand, the determination of a formant is just a resonance of the vocal tract rather than the actual excitation of the air within the vocal tract. This is a different procedure from the pitch determination, since a pitch is strongly varying over frequency in time, and the formant is not.

In view of this, Holton does not disclose any pitch analyzer as discussed in the last paragraph of Claim 1.

Holton has some occurrences of the word "pitch", but never discloses any pitch analysis and any pitch line over time. These occurrences are in col. 9, line 58, but this passage is only directed to a certain response pattern, which is not pertinent and which is not raised by the Examiner, since the Examiner did not recite a specific portion for the pitch analyzer apart from Fig. 2A and Fig. 2B, which evidently do not show a pitch analyzer, but an illustration of response pattern generated by a peripheral auditory filtering stage, *i.e.* time lines of a signal in a certain channel. Applicants cannot see any relation of Fig. 2A or Fig. 2B to pitch.

A different occurrence of the word "pitch" is in col. 16, line 46, but again, this passage only describes the temporal extent of a computation and also states that this temporal

extent of a computation is a small fraction of a pitch period, which is definitely not a pitch analyzer.

Col. 18, line 37 underlines that the representation of a formant information is highly localized in frequency which means that the formant does not vary in frequency over time, but is always on the same frequency, and, therefore, the frequency-channel dependent processing in Holton is logical, but this is not what we have in the invention, since the pitch is varying heavily.

Then, in col. 19, lines 21 to 32, Holton states that the invention is different from prior art pitch detectors and which also emphasizes that Holton does not disclose a pitch analyzer as defined in Claim 1.

### **35 USC 103(a)**

The Examiner rejects Claims 5-8 under 35 USC 103(a) as being unpatentable over Holton in view of Herre (U.S. Pub. No. 2004/0094019).

Regarding Claim 5, the Examiner points to Herre for support. The Examiner, however, overlooks the feature that, in accordance with the invention, a summary auto correlation function for each time period of a number of time periods is calculated using the estimates for the transmitter concentrations of the number of inner hair cells. This feature is not at all disclosed in Herre. The Examiner simply overlooks the feature of summary auto correlation function and based on which this summary auto correlation function is defined in the second paragraph of Claim 5. Therefore, Claim 5 does not simply say to use an auto correlation function, but Claim 5 defines a very specific summary auto correlation function as defined in the second paragraph of Claim 5.

Regarding the last paragraph of Claim 5, this paragraph clearly discloses a period between two adjacent maxima of the summary auto correlation function, but this feature has been simply ignored. Furthermore, the cited passage of Holton does not even mention the step of entering a result into a summary auto correlation function histogram. In fact, even a histogram is not mentioned here or any maximum of anything. Thus, the Examiner improperly overlooks the limitations in Claim 5.

Regarding Claim 6, the Examiner points to col. 17, lines 56-67 regarding a maximum value of the histogram, but this passage as well as the passage on col. 18 does not even disclose a histogram and, therefore, also cannot disclose a maximum value of a histogram and that this maximum value indicates the pitch in a time period.

Instead, the passage cited by the Examiner only finds, whether in a range of channels an amplitude of a formant is less than the formant of the next lower channel, which is definitely not a histogram. Applicants submit that Holton is relevant because it does not even contain mention the term "histogram".

Regarding Claim 7, the Examiner points to completely different passages in Holton, although Claim 7 is clearly tied to Claim 6. Nevertheless, col. 8, lines 58-67 and all other passages do not teach a pitch line subtrajectory, but is a time line of a certain value in a channel, such as  $\Delta_i$ , or DIFIT<sub>1</sub> or impulse<sub>1</sub> as outlined in Fig. 1. This is definitely not a pitch line subtrajectory.

Regarding Claim 8, where the fusage of these pitch line subtrajectories is mentioned, the Examiner's citation is not correct either, since all passages cited by the Examiner are not at all related to any pitch.

Again, page 22, lines 36 and 37 emphasize that Holton is interested in the formants and glottal pulses, but is not interested in any pitches.

Additional limitations recited in the independent claims or the dependent claims are not further discussed because the limitations discussed above are sufficient to distinguish the claimed invention from the cited art.

**Conclusion**

In view of the above, Applicants respectfully posit that the pending claims are allowable. The Examiner is invited to please contact Applicants' attorney at (650) 474-8400 should any questions arise.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'E. Ruzich', is positioned above the printed name.

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